Grounding the South Forty

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Sponsored by the Photovoltaic Systems Assistance Center, Sandia National Laboratories

We have been up to our ground rods in grounding in *Home Power 72 & 73.* Here is the last installment on grounding—at least for this year. It will be easy and short, and it will save you money. We are going to ground the PV array that is located away from the building or structure that contains the power center/inverter.

In past *Code Corner* columns, I have hammered on the fact that there can be one and only one bonding connection between the grounded current-carrying conductor (usually the negative conductor) and the ground system. Well, there are exceptions to many requirements in the *National Electrical Code (NEC),* and this is one of those exceptions.

This alternate grounding method can be used when the following conditions are met:

- The PV array is ground mounted some distance away from other PV components (inverter, batteries, etc.). The distance is not specified in the *NEC,* but I would suggest at least 30 feet (9 m). The PV array may also be mounted on a separate structure as long as there are no conductive paths as described below, including AC power circuits.
- There are no conductive paths (electrical or other) such as water pipes, metal fences, communication circuits, or telephone circuits between the array and the other structure.

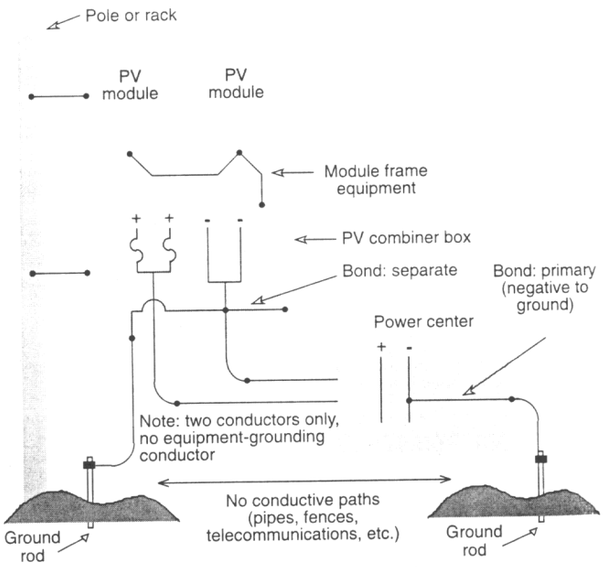
If these conditions are met, the PV array may be grounded as follows. The PV modules are connected to the equipment-grounding conductors, as the module instructions require. The module/array tracker frame or rack is also connected to the equipment-grounding conductors, as are any enclosures at the array used for PV source circuit combiners.

These equipment-grounding conductors should terminate at one location—probably a grounding terminal strip in the combiner box. Then, there should be a conductor from this point to the grounding electrode (ground rod). All of this is the same for grounding any PV array. Now comes the difference.

The negative current-carrying conductor is bonded (connected) to the grounding system at the PV array and there is no equipment-grounding conductor run from the PV array to the power center or charge controller. This eliminates the cost and complexity of running the equipment-grounding conductor from the south forty to the power center. The normal negative-to-ground bonding is still required in the power center or ground-fault device (if used).

It should be noted that this grounding method meets the requirements of the NEC and is very similar to the grounding of AC circuits in separate structures described in the *Code Corner* column in *HP65.* The figure below shows the connections.

Grounding the Separately Located PV Array



Summary

There are two ways to ground a remote array:

1) Meet the two conditions and bond the negative conductor (on a negatively grounded system) to the grounding system at both the array and at the inverter/battery/power center location. Do not run any equipment grounding conductors between the two locations. Use ground rods at both locations. Do not bond ground rods together.

If the two conditions cannot be met, then this method must be used:

2) Do not bond the negative to the grounding system at the array. Bond the negative (on a negatively grounded system) only at the inverter/battery/power center. Run an equipment grounding conductor between the two locations. Use ground rods at both locations.

Check the restrictions listed above. If they are met, eliminate that array-to-power center equipment-grounding conductor and save some money. But don't forget to bond the PV negative conductor to the grounding system at the PV array.

Questions or Comments?

If you have questions about the *NEC* or the implementation of PV systems following the requirements of the *NEC,* feel free to call, fax, email, or write me at the location below. Sandia National Laboratories sponsors my activities in this area as a support function to the PV industry. This work was supported by the United States Department of Energy under Contract DE-AC04-94AL8500. Sandia is a multi-program laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy.

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Wiles, J. C. and Bower, W. I., *Analysis of Grounded and Ungrounded Photovoltaic Power Systems,* First World Conference on Photovoltaic Energy Conversion, Hawaii, 1994